

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of)	
)	
Amendment of Parts 1, 2, 22, 24, 27, 90 and 95 of)	WT Docket No. 10-4
the Commission's Rules to Improve Wireless)	
Coverage Through the Use of Signal Boosters)	

REQUEST FOR WAIVER

Nextivity, Inc. ("Nextivity"), pursuant to Sections 1.3 and 1.925 of the Commission's Rules, hereby requests waivers of certain provisions of Sections 20.21 and 90.219 of the Commission's Rules in connection with the proposed use of signal booster equipment in the FirstNet national public safety broadband network.¹ In particular, Nextivity requests waiver of the following:

(1) Section 20.21(e)(3), which authorizes consumer signal boosters in the 700 MHz band only in the Lower A-E blocks and Upper C block;

(2) Section 20.21(e)(9)(i)(D), which limits a booster's uplink power to 1 watt composite conducted power and EIRP for each band of operation;

(3) Sections 20.21(a) and (g), which prohibit the sale of consumer signal boosters except to the general public for personal use, and

(4) Section 90.219(d)(7), which prohibits the passband of a Class B booster from encompassing both commercial and Part 90 services.

A grant of the requested waivers will facilitate the implementation of FirstNet and enable delivery of greatly improved critical public safety services to the American public. Grant of the

¹ 47 C.F.R. §§ 20.21, 90.219.

requested waivers will also serve the Commission's goals to foster device innovation and more efficient use of scarce spectrum resources while protecting wireless services, including public safety services, from harmful interference.

I. BACKGROUND

Nextivity is a California-based leading signal booster manufacturer whose products aim to optimize cellular signal transmission benefiting both users and wireless carriers. Nextivity's provider-specific signal boosters are used by carriers in the United States and around the world. Nextivity contributed important technical and industry expertise and experience to the development of Commission rules in WT Docket No. 10-4 that enabled the introduction of consumer and industrial signal booster equipment.² In particular, Nextivity, working together with Verizon and T-Mobile, developed a proposal that was instrumental to establishing out-of-band emissions and registration requirements for wideband and provider-specific consumer boosters. Today, Nextivity distributes provider-specific signal consumer booster equipment in compliance with the Commission's Rules.

Nextivity is currently working with bidding teams interested in implementing the FirstNet contract to build and operate the national public safety broadband network operating in the 700 MHz band. The FirstNet system will be the first dedicated, nationwide, interoperable, mission-critical data communications system for first responders and will be designed to carry some of the country's most sensitive communications for the next 25 years. It is widely seen as providing much-needed critical communications capabilities to first responders in times of

² See Report and Order, *In the Matter of Amendment of Parts 1, 2, 22, 24, 27, 90, and 95 of the Commission's Rules to Improve Wireless coverage Through the Use of Signal Boosters*, WT Docket No. 10-4, FCC 13-21 (rel. Feb. 20, 2013) (2013 R&O).

terrorist attacks, weather and other natural disasters, and myriad everyday situations in which first responders are called to assist.

A. The FirstNet Network has Unique Coverage and Operational Characteristics

The FirstNet network will be expected to meet more rigorous coverage and operational requirements than any other nationwide network built to date. Ubiquitous coverage will be mission critical. Outdoor coverage will need to extend to rural areas. Extending the FirstNet footprint to equal or better than P.25 coverage is viewed as key in determining the adoption speed of FirstNet services. One challenge facing FirstNet implementation is to provide service in rural areas where FirstNet has not built facilities, which will likely be the case for many rural and remote areas at least for some initial period of time.

Another challenge for public safety communications is to ensure in-building coverage where cell coverage is often spotty or nonexistent. Indoor coverage in commercial buildings will need to be greater than 99% in designated critical areas and greater than 90% in general use areas. 115 dBm RSRP or better signal levels will be the minimum expectation.

Public safety traffic, including voice, video and data, will be required to have the highest priority. When networks are shared with commercial networks, priority pre-emption will be mandatory. FirstNet will need to be a highly resilient network that reliably operates under a wide variety of adverse conditions. Enclosures, battery backup and alarm monitoring for key installations will all need to meet the demanding rigors of the public safety network.

Although government cost estimates for construction of the network are up to \$47 billion, only \$6.5 billion will be available from funds allocated by Congress with the remainder of expenses to be paid by the commercial use of the FirstNet spectrum. Given the challenge of developing this unique network with limited resources, it is expected that the FirstNet network

will be rolled out in multiple frequency bands. Use of the \$6.5 billion will likely be devoted first to service on the FirstNet 700 MHz frequencies to serve underserved areas. In areas with good commercial cellular network coverage, FirstNet traffic will be carried with priority preemption rights. The frequency band in use at any one time -- whether FirstNet 700 MHz frequencies or commercial frequencies -- will dynamically change depending on available network capacity and extent of coverage at the targeted location. Thus, FirstNet services will co-exist with services and applications delivered over commercial networks. Accordingly, any boosting technology developed to work within the FirstNet system must be able to support this hybrid mode of operation.

B. Nextivity's FirstNet Booster Solution

Keeping in mind FirstNet's compelling public safety purpose and very challenging cost and coverage considerations, Nextivity is developing a family of carrier-grade provider-specific signal boosters that can be employed in the FirstNet network to extend the reach of FirstNet's 700 MHz-based service. To achieve the necessary coverage, Nextivity's public safety booster will dynamically use either FirstNet 758-769 MHz and 788-799 ("Band 14") frequencies or commercial frequencies, depending on where the FirstNet service is carried. Advanced gain control algorithms and massively parallel hardware processing engines guarantee no uplink noise rise, even under fast changing mobile conditions. This ensures optimal network performance. Built-in LTE and HSPA modem technology allows the booster to automatically tune or roam to the Public Safety specific frequency or PLMN-ID without any user intervention. All system level settings are performed automatically after scanning the environment for cellular signals, decoding MIB and SIB information and optimally configuring the system.

Coverage will also be established by utilizing a higher power uplink for user equipment of 31 dBm +2/-3 dBm or 2 Watts maximum, consistent with 3 GPP standards for Band 14. Advanced gain control algorithms coupled with digital, multi-tap interference cancellation algorithms ensures the highest system gains allowed under Part 20 rules for provider-specific boosters can be achieved. Furthermore, the provider-specific consumer signal boosters remain unconditionally network safe as the output power levels can be dynamically managed to step up to 31 dBm only when the system is at the very edge of the network. Whenever the system is utilized closer to base stations, the output power levels can be limited to current Part 20 specified levels. Nextivity's use of advanced signal processing techniques provides up to 4 dB improvement in link budget and, coupled with the proposed higher output power level, can extend the radius of a standard 20 W base station from 18 km to 42 km.

Nextivity's public safety signal booster equipment provides a cost effective solution to eliminate dead spots in buildings on Band 14 and/or any other commercial bands with coverage outside the building but not inside the building. With use of Nextivity's boosters, the percentage of customers with indoor coverage problems falls from >5% to <2% without making any additional network investment.³

Finally, Nextivity's public safety booster equipment is ruggedized and configured to meet enhanced resilience requirements. Robust enclosure options are available for all products (e.g., NEMA 4 or IP68). Optional battery backup for up to 12 hours of operation will be available for small office products. Booster users will also have the option of alarm monitoring.

³ Additionally, first responders and/or building owners will be able to solve coverage issues locally using a convenient, proven self-installation model for Nextivity's booster products.

II. REQUEST FOR NECESSARY WAIVERS TO IMPLEMENT NEXTIVITY FIRSTNET SIGNAL BOOSTER SOLUTION

Nextivity developed the public safety booster solution described above to address the unique needs of first responders using the FirstNet nationwide interoperable public safety broadband network. Nextivity's public safety booster solution meets the special requirements of coverage, availability and resilience of the FirstNet network but does not fit completely within the Commission's existing provider-specific consumer signal booster rules. Accordingly, Nextivity requests waivers of Sections 20.21(a), (e)(3), e(9)(i)(D), and (g) as well as Section 90.219(d)(7) to allow for certification of equipment that will implement Nextivity's public safety signal booster.⁴

A. Nextivity's Request for Waiver Meets the Commission's Waiver Standard

Section 1.3 of the Commission's Rules provides that a waiver will be granted if "good cause" is shown.⁵ The Commission may exercise its discretion to waive a rule where the particular facts make strict compliance inconsistent with the public interest.⁶ In fact, the Commission has an "obligation to seek out the 'public interest' in particular, individualized cases."⁷ However, a granted waiver cannot undermine the policy behind the rule.⁸

While the Commission need not "reconsider policy every time it receives an application for waiver of [a] rule," it must give a "hard look" to whether a general rule in the public interest

⁴ While Nextivity has identified the rule sections listed above as requirements that Nextivity's public safety booster would not meet, it is possible that the Commission determines that a waiver is required for other rule sections. Accordingly, Nextivity also seeks waiver of any additional rule provisions that may be deemed necessary for the implementation of Nextivity's public safety signal booster and, upon notice, will submit any necessary supplemental information to support such waivers.

⁵ 47 CFR § 1.3.

⁶ See *Northeast Cellular Telephone Co. v. FCC*, 897 F.2d 1164, 1166 (D.C. Cir. 1990) (*Northeast Cellular*).

⁷ *WAIT Radio v. FCC*, 418 F.2d 1153, 1159 (D.C. Cir. 1969) (*Wait Radio*).

⁸ *Id.*

should not be extended to an applicant whose proposed service is in the public interest.⁹ In assessing an application for waiver, the Commission should take into account considerations of hardship, equity, or more effective implementation of overall policy on an individual basis.¹⁰ In short, the Commission has determined that a waiver is appropriate if (i) special circumstances warrant a deviation from the general rule; (ii) such deviation will serve the public interest; and (iii) waiver would not undermine the policy objective of the underlying rule.¹¹ Nextivity submits that a waiver of the rules detailed below is justified because of the special circumstances surrounding the implementation of the FirstNet network, the compelling public interest in facilitating the first nationwide interoperable public safety network, and the requested waivers will not undermine or otherwise adversely affect the ongoing application of the signal booster rules in other situations. Implementation of Nextivity's booster solution in the FirstNet context would serve the compelling public interest of improving emergency and other services for first responders nationwide.

The Commission adopted the signal booster rules to balance the overall goal of increasing wireless coverage for consumers through the use of signal boosters with ensuring that wireless networks will be protected from interference from boosters. These concerns are minimized in the case of the proposed Nextivity public safety LTE signal boosters, a specialized solution in which the risk of interference to public safety users or commercial network users is eliminated given that the affected services will be within the control of the public safety and potentially affected commercial operator.

⁹ *Id.*

¹⁰ *Id.* (“[C]onsideration of hardship, equity, or more effective implementation of overall policy [are] considerations that an agency cannot realistically ignore, at least on a continuing basis.”); *Northeast Cellular*, 897 F.2d at 1166.

¹¹ *Northeast Cellular* at 1166.

B. Request for Waiver of Applicable Sections

Nextivity specifically requests waivers of Sections 20.21(a), (e)(3), e(9)(i)(D), and (g) as well as Section 90.219(d)(7) to allow for this special use provider-specific consumer booster. The Commission adopted these rules¹² to balance the overall goal of increasing wireless coverage for consumers through the use of signal boosters with ensuring that wireless networks will be protected from interference from boosters. The Part 20 rules for which Nextivity requests a waiver are all targeted to reducing or mitigating interference potential between boosters and wireless services. In particular, Nextivity requests waivers of the rules limiting frequencies for consumer signal boosters, imposing power limits on signal booster operation, limiting consumer signal boosters to personal use, and the rule prohibiting dual user of Part 90 and commercial frequencies.

1. Frequency Rule

Nextivity hereby seeks a waiver of Section 20.21(e)(3) which limits consumer signal booster use to frequencies under Parts 22, 24, 27.¹³ Operation in Part 90 frequencies is permitted only upon a Commission release of a public notice announcing the date Consumer Signal Boosters may be used in the band which, to date, has not been issued.¹⁴ Under the current rules, use of Consumer Signal Boosters in the 700 MHz band is limited to the Lower A-E Blocks (698-728 MHz) and the Upper C Block (776-782 MHz).¹⁵ Nextivity's public safety boosters are

¹² Report and Order, *In the Matter of Amendment of Parts 1, 2, 22, 24, 27, 90, and 95 of the Commission's Rules to Improve Wireless coverage Through the Use of Signal Boosters*, WT Docket No. 10-4, FCC 13-21 (rel .Feb. 20, 2013) (2013 R&O).

¹³ 47 C.F.R. 20.21(e)(3),

¹⁴ 2013 R&O at ¶36; fn. 82; 47 C.F.R. 20.21(e)(3)

¹⁵ 47 C.F.R. 20.21(e)(3)

designed specifically to extend and enhance FirstNet LTE coverage of Band 14 frequencies (758-769 MHz and 788-799 MHz) designated for FirstNet operations under Part 90.

The Commission's rationale for imposing these spectrum limitations was driven by concern for interference: it noted that unlike industrial signal boosters, which are "typically professionally installed and closely coordinated with affected licenses," consumer boosters may be portable and installed by individuals with no technical expertise.¹⁶ In bands where consumer signal booster operation is permitted, for example the specified blocks of the 700 MHz band, the Commission has noted that its decision is guided "by whether consumers are likely to benefit from the prospective use of boosters in that band," and whether use of boosters will "help extend new and innovative services...to the public."¹⁷ A waiver is warranted here because Nextivity's public safety signal booster is a specialized solution in which the risk of interference to public safety users or other Part 90 users or commercial network user is minimized given that the affected services will be within the control of the public safety and potentially affected commercial operator.

Moreover, the present restriction on Part 90 booster operation was implemented in deference to ongoing, nationwide band reconfiguration in the 800 MHz Specialized Mobile Radio Service (SMRS) band.¹⁸ Specifically, the Commission held that "the benefits of using Consumer Signal Boosters...are outweighed by the risk that some boosters could still be diverted for use in an area still undergoing band reconfiguration and therefore possibly interfere with

¹⁶ 2013 R&O at ¶36. In bands where consumer signal booster operation is permitted, for example the specified blocks of the 700 MHz band, the Commission has noted that its decision is guided "by whether consumers are likely to benefit from the prospective use of boosters in that band," and whether use of boosters will "help extend new and innovative services...to the public." *Id.*

¹⁷ *Id.* at ¶36.

¹⁸ *Id.* at ¶39-40.

public safety operations.”¹⁹ The Commission has directed the Public Safety and Homeland Security and Wireless Telecommunications Bureaus to determine when nationwide configuration would be completed and issue a Public Notice announcing the date consumer signal boosters may be used in the band.²⁰ Here, no risk of interference exists because Nextivity’s boosters will not operate unless the public land mobile network identity (PLMN-ID) of the FirstNet network is positively verified.

2. Power Limits

Nextivity hereby seeks a waiver of Section 20.21(e)(9)(i)(D), to increase the uplink power of a signal booster operating in Band 14 to 31 dBm +2/-3dBm (2 W max), for devices that use the forward pilot/control channel power method to determine BSCL (20.21(e)(9)(i)(C)(1)(i)). Currently, Section 20.21(e)(9)(i)(D) imposes power limits on all signal booster operations, including in Band 14. This rule limits for each band of operation a booster’s uplink power to 1W EIRP, and downlink power to 0.05 W (17dBm) and 10 dBm per channel conducted and EIRP for each band of operation.²¹ Nextivity seeks a waiver of Section 20.21(e)(9)(i)(D) for operations on Band 14 only, without change to the power limits applicable to operations in non-Band 14 frequencies.

Nextivity’s products aim to address the difficulty of extending FirstNet coverage to rural areas in a cost effective manner. By utilizing signal boosters with higher power on the uplink, Nextivity effectively allows for cell radiuses to be extended over twice the distance for a

¹⁹ *Id.* at ¶39.

²⁰ Footnote 82 of the 2013 R&O, which states that operation of consumer signal boosters on Part 90 frequencies are permitted only upon the Commission’s release of a public notice, cites to this directive. *Id.* at ¶40.

²¹ 47 C.F.R. 20.21(e)(9)(i)(D),

standard 20 W base station. Consistent with other Section 20.21 requirements, these power limits are part of requisite technical specifications designed to protect against interference.²²

Nextivity's specialized public safety solution will enable greater reach of the FirstNet network as required in rural and remote areas but will not raise interference concerns because FirstNet and its commercial contractor will be able manage the use and any potential interference that could arise from the increased power limit as appropriate. Moreover, grant of the requested waiver will not have any adverse interference impact on CMRS license holders or end users operating in adjacent bands. By limiting the waivers to Band 14 operation with systems that measure actual path loss to the base station, all base stations will be protected to the same extent as is currently provided for by the rules in Section 20.21. Essentially, the higher output power level can only be achieved if the path loss to the base station is sufficiently high. In addition, Nextivity has incorporated into its booster operations several mitigating measures to preclude network interference to other users. For example, Nextivity's boosters have fast gain control algorithms that turn off the booster when no input signal is detected on the uplink as well as proprietary uplink interference reduction techniques that have been proven robust in more than 180 LTE networks across the world.

3. Personal Use

Sections 20.21(a)²³ and 20.21(g)²⁴ limit operation and sale of consumer signal boosters to members of the general public for personal use. The Commission issued these rules in the 2013

²² 2013 R&O at ¶60.

²³ 47 C.F.R 20.21(a) (allowing for operation of a consumer signal booster for "personal use.").

²⁴ 47 C.F.R 20.21(g) ("[N]o person, manufacturer, distributor, or retailer may market, distribute or offer for sale or lease any Consumer Signal Booster that does not comply with the requirements of this section to any person in the United States or to any person intending to operate the Consumer Signal Booster within the United States at any time on or after March 1, 2014. Consumer Signal Boosters may only be sold to members of the general public for their personal use.").

R&O and has since sought comment on whether the personal use restriction should be adjusted or removed in furtherance of the 2013 R&O's goals to broaden the availability of signal boosters while protecting against adverse interference to wireless networks.²⁵

The intent of the personal use restriction is to facilitate a streamlined licensing framework for consumer signal boosters such that wireless operators were not impeded with respect to control of their networks.²⁶ Carrier consent to the use of a consumer signal booster is obtained in connection with the equipment certification process. Consumers advise their carriers of the use of booster devices by registering each device with the wireless carrier to which they subscribe.²⁷ The personal use restriction was particularly targeted to wideband consumer signal boosters, which are capable of operating on spectrum licensed to multiple wireless providers.²⁸ The Nextivity public safety signal boosters are provider-specific booster solutions that will be used with the specific consent of the FirstNet licensee and the operator of both the FirstNet network and the commercial network used to serve first responders. There is no scenario in which the signal booster will be used on a network without the specific permission of the network operator.

4. Dual-Use Prohibition

To the extent necessary, Nextivity hereby seeks a waiver of Section 90.219(d)(7), which disallows the passband of a Class B booster from encompassing both commercial and Part 90

²⁵ Order on Reconsideration and Further Notice of Proposed Rulemaking, *In the Matter of Amendment of Parts 1, 2, 22, 24, 27, 90, and 95 of the Commission's Rules to Improve Wireless coverage Through the Use of Signal Boosters*, WT Docket No. 10-4, FCC 14-139 (rel. Sept. 23, 2014) (Order on Recon) (seeking comment on whether to retain the "personal use" restriction for Provider-Specific Consumer Signal Boosters).

²⁶ 2013 R&O at ¶4, 22; Order on Recon at ¶26.

²⁷ 2013 R&O at ¶48; Order on Recon at ¶26.

²⁸ *Id.*

services (“dual use”).²⁹ This rule was promulgated in the 2013 R&O to “address the situation in 800 MHz spectrum where both subscriber-based systems and PLMR systems operate on adjacent bands, and the same signal booster is used to amplify both.”³⁰ The Commission voiced concern that class B signal boosters should not be allowed on interleaved Part 90 channels, citing the “additional complications” that interleaved Part 90 channels present for controlling interference.³¹ Based on this concern, the rule was promulgated in the 2013 R&O as an effort to limit the interference potential of signal boosters, which amplify thermal noise and add random noise of their own.³²

Application of the dual use prohibition is not necessary in the FirstNet context to prevent interference between Part 90 and commercial frequencies. The Nextivity public safety booster is not designed to be used on interleaved Part 90 channels. Moreover, because the entities that would utilize Nextivity’s public safety signal boosters operating on Band 14 and on commercial frequencies are the same, interference would not pose an issue since the signal booster will operate with the specific consent and control of the public safety network and commercial network operator. Consistent with the requirements that apply to other consumer boosters, users of public safety consumer boosters will register their boosters with the carrier.

²⁹ 47 C.F.R. 90.219(d)(7).

³⁰ 2013 R&O at ¶177.

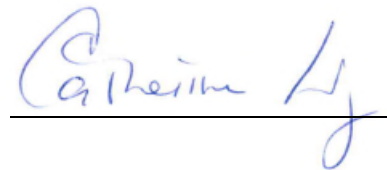
³¹ Notice of Proposed Rulemaking, *In the Matter of Amendment of Parts 1, 2, 22, 24, 27, 90, and 95 of the Commission’s Rules to Improve Wireless coverage Through the Use of Signal Boosters*, WT Docket No. 10-4, FCC 11-53 (rel .Apr. 6, 2011) at ¶81.

³² 2013 R&O at ¶177 (“Because signal boosters amplify thermal noise, as well as the desired signals (and add random noise of their own), we believe that limiting the passband of devices to the intended service band of the licensee will further limit the interference potential of the device.”).

III. CONCLUSION

FirstNet implementation faces ongoing funding and technology challenges. Facilities build out will likely take years and will be completed in phases. It is expected that build out of FirstNet public safety facilities will be prolonged in significant areas many of which are likely to be rural and remote areas. In the meantime, first responders and the citizens they serve, will need access to all available spectrum sources, including commercial spectrum, to meet public safety needs. Nextivity's public safety signal booster solution will provide an important option to extend quickly cellular coverage and make use of commercial frequencies without causing interference to wireless networks and without the delay and substantial expense of establishing new base stations. If the requested waivers are granted, Nextivity will be able to bring to market a cost-effective and spectrum-efficient solution to meet the critical needs of the nation's public safety community. For the foregoing reasons, Nextivity respectfully requests a grant of the rule waivers described herein.

Respectfully submitted,

A handwritten signature in blue ink, appearing to read "Catherine Wang", is written over a horizontal line.

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